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Title: TEST PIT SOIL SAMPLING AT SMELTER FACILITIES

APPROVALS:

Author:_____ISSI Consulting Group, Inc. Date: _____

SYNOPSIS: A standardized method for collecting test pit soil samples at smelter facilities is described. Protocols for sample collection and handling are provided.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
USEPA Region 8	_____	_____
ISSI Consulting Group, Inc.	_____	_____

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide a standardized method for test pit sampling at smelter facilities, to be used by employees of USEPA Region 8, or contractors and subcontractors supporting USEPA Region 8 projects and tasks. This SOP describes the equipment and operations used for sampling sub-surface soil at smelter facilities, to produce data that can be used to support risk evaluations. Deviations from the procedures outlined in this document must be approved by the USEPA Region 8 Remedial Project Manager or Regional Toxicologist prior to initiation of the sampling activity.

Collection and measurement of samples and the documentation of data will be performed as described in the associated procedures.

2.0 RESPONSIBILITIES

The Field Project Leader (FPL) may be an USEPA employee or contractor who is responsible for overseeing the field sampling activities. The FPL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and the Project Plan. It is the responsibility of the FPL to communicate with the Field Personnel regarding specific collection objectives and anticipated situations that require any deviation from the Project Plan. It is also the responsibility of the FPL to communicate the need for any deviations from the Project Plan with the appropriate USEPA Region 8 personnel (Remedial Project Manager or Regional Toxicologist).

Field personnel performing test pit soil sampling are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples. The field personnel should have limited discretion with regard to collection procedures, but should exercise judgment regarding the exact location of the Sample Point, within the boundaries outlined by the FPL.

3.0 EQUIPMENT

- Stainless steel or plastic hand trowel – for collecting soil from the test pit walls.
- Collection containers - plastic zip-lock bags.
- Gloves - for personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.
- Field clothing and Personal Protective Equipment - as specified in the Health and Safety Plan.

- Field notebook -a bound book used to record the progress of the sampling effort and record any problems and field observations during sampling.

- Three-ring binder book- to store necessary forms used to record and track samples collected at the VBI70 site. Binders will contain the Surface Soil Data Sheet, Site Diagram, Test Pit Log, and sample labels for each day. Example forms are provided in Attachment 1 and Attachment 2.

- Permanent marking pen - used as needed during sampling and for documentation of field logbooks and data sheets.

- Squeeze bottle -for dispensing potable (drinking) quality water. Used to clean and decontaminate sampling equipment. Bottles must be labeled "drinking water".

- Squeeze bottle - for dispensing deionized water. Used to clean and decontaminate sampling equipment. Bottles must be labeled "DI".

- Trash Bag - used to dispose gloves and wipes.

- Laboratory Surfactant – used for equipment decontamination. Alconox is a brand in common use.

- Flagging Tape – used to mark sampling locations and/or distinct units on the wall of the test pit.

4.0 SAMPLING PROCEDURE

Before beginning the field test pit excavation program, office and field management personnel should obtain information about geologic conditions expected at the site. The investigation team should be composed of technical specialists with backgrounds in fields of geology, engineering geology, or geotechnical engineering. Mapping the trench walls and sampling should be conducted by the members of the investigative team. The construction subcontractor should be responsible for supplying excavation equipment, trained operators, materials for shoring the trench walls, and the preparation of the walls for mapping.

To the extent possible, test pits will be located at flue, baghouse, waste transfer or other historical facilities that may constitute a potential source of arsenic and lead. At each test pit location, samples will be collected from each distinct strata. If units are wider than 12

inches, samples will be collected at the following intervals: 0 to 1 feet, 1 to 2 feet, 2 to 3 feet, 3 to 4 feet, and 4 to 5 feet below the surface.

4.1 Trench Excavation

Excavate a trench with a backhoe that uses a 2- to 3-ft-wide bucket capable of efficient excavation to a depth of 5ft.

A. Remove and stockpile the topsoil before trench excavation. Make shallow cuts of 1- to 2-ft depth and stockpile the material on the downwind or downslope side of the trench. Maintain ample space (a minimum of 2 ft) between the stockpiled material and the trench to maneuver excavation equipment.

B. Maintenance of stable walls, particularly in deep trenches, is best accomplished with straight-line sections. Because shoring in corners or curve areas is potentially ineffective, avoid the excavation of nonlinear trenches.

C. Make trench walls vertical, uniform in width, and as smooth as practical to facilitate the efficient use of portable shoring braces. Safety precautions, including the use of shoring braces, trench access, and trench stability, are the responsibility of the contractor performing the excavation. At all times, relevant safety laws and precautions must be followed.

D. Place excavated subsoil as a windbreak on the upwind or upgradient side of the trench. Maintain sufficient space (a minimum of 2 ft) between the material and the trench edge to ensure that it will not fall back into the trench or impede the advancement of the backhoe.

E. Depending on the strength of the surficial deposits being trenched, mapping may occur concurrently with the advancement of the trench. The site geologist and an assistant should conduct the mapping of the trench wall at a safe distance behind the backhoe, lessening the risk of exposure to caving induced by backhoe vibrations. One team member should remain at the surface to direct the excavation activity and assist the trench wall mapping team. The topside member can ensure that the backhoe operator excavates the trench as specified by the site geologist, who should advise the backhoe operator of the trench conditions requiring immediate attention and direct the operator to trim and terrace walls when appropriate. The safety of the trench mappers is the paramount responsibility of the topside team member, who should be constantly alert for indications of potential wall caving (like tension

cracks). All persons entering any portion of the trench should wear personal equipment for protection of the head and eyes.

F. Plot physical attributes (see Attachment 2) of units that are distinct in terms of lithology, texture, or color, using feet and inches, plus or minus the baseline elevation and station position. In addition to bedding planes and lithologic interfaces, geologic features (like cobble strings) may aid in following stratum continuity, particularly if individual units are difficult to discern. Assessment of stratigraphy in a deposit lacking distinct strata or containing similar geologic units may be aided by the use of a 5-ft-square aluminum frame marked with string in a 1-ft grid pattern. Other features like large boulders of organic debris should also be mapped.

G. Visual Description. Description of the soil will be according to the ASTM Designation D 2488-84, Standard Recommended Practice for Description of soils (Visual-Manual Procedure).

H. The technical specialist assisting the mapper in the trench should prepare the trench wall ahead of the mapper using nails and string line and highlighted with plastic flagging tape. Physical support of the grid frame when mapping the middle and upper reaches of a trench wall will be the responsibility of this person.

I. At each sampling location, two photographs should be taken. The first should record the unaltered appearance of the wall. The second should record the same location after it has been divided into a grid reference using nails and string line and highlighted with spray paint. Take flash photos if ambient light is not sufficient for a clear, bright exposure.

J. Collect samples from the trench wall according to Section 4.2.

4.2 Soil Sample Collection

After each pit has been excavated with the backhoe, use a stainless steel or plastic trowel hand trowel to collect grab samples from each one-foot depth interval from the vertical wall of each pit. A minimum of 500 grams will be collected from each depth increment. The samples should be placed directly into the sample containers. Containers must be labeled according to the procedure described in Project Plan. The sample ID label, date, time of collection and a log of the sample will also be recorded in the field book, as described in Section 6.0. Seal, label, and store the container as specified in the Project Plan. Samples should be transported according to the procedures described in the Project Plan.

The backhoe bucket must be decontaminated between pits, using a portable steam pressure washer. The hand trowel must be decontaminated between each sample depth increment and location using the procedure described in Section 7.0.

5.0 SITE CLEANUP

It is important at most sites that the restored site is as close to the original surface contour as practical. Compact the backfill by wheel rolling with the backhoe or loader to accomplish this objective.

In pastureland or any place where restoration is required and vegetation cover is important, replace the topsoil that was excavated and stockpiled from the trench at the end of the restoration process. After the surface is wheel rolled and dressed down, restore the area as specified by the access agreement.

A. Fill the test pit to its original level.

B. Ensure that all equipment is accounted for, decontaminated and ready for transport.

C. Restore the site to presampling conditions.

D. Make sure the test pits are properly staked and the location ID is readily visible on the location stake.

6.0 RECORDING KEEPING AND QUALITY CONTROL

A field notebook should be maintained by each individual or team that is collecting samples, as described in the Project Plan. The Project Plan will detail specific conditions which require attention, but at a minimum the following information should be collected.

- date
- time
- personnel
- weather conditions
- a diagram of the sampling trench that is filled in with sample identification numbers as the samples are collected
- locations of any samples and sub-samples that could not be acquired
- descriptions of any deviations to the Project Plan and the reason for the deviation.
- photographs from each sample location

In addition, a test pit log must be completed for each trench. A sample logbook page and instructions for filling out the data form are included in Attachment 2. Field personnel will collect the proper type and quantity of quality control samples as prescribed in the Project Plan.

7.0 DECONTAMINATION

Because decontamination procedures are time consuming, having a quantity of sampling tools sufficient to support decontamination at a maximum of once per day is recommended. All sampling equipment must be decontaminated prior to reuse.

The procedure to decontaminate all hand-held sampling equipment is outlined below:

1) Remove visible soil.
2) Rinse equipment with potable water.
3) Rinse in a surfactant solution.
4) Rinse equipment with potable water.
5) Triple rinse with deionized water.

Washing should be performed by sequential immersion of the equipment in buckets partially filled with these solutions. If necessary, a brush should be used to remove soil material from screens and coring tools. Equipment should be set on clean toweling to dry. Equipment should be visibly dry before being used again.

Wipes, gloves, and rinse solutions must be disposed or stored properly as specified in the Project Plan.

8.0 REFERENCES

ASTM. 1986. Standard Recommended Practice for Description of Soils (Visual-Manual Procedure)," 411-25, ASTM D:2488-84. American Society of Testing Methods, Philadelphia, Pennsylvania.

HYDROMETRICS. 1995. Engineering Evaluation/Cost Analysis Workplan for Former Murray Smelter Site. Publication 339137-339138. September 1995.

ATTACHMENT 1

Attachment 1

SMELTER SOIL DATA SHEET

PHASE: SC

MEDIUM: Smelter Soil

SAMPLE COLLECTION METHOD: ISSI-VBI70-08 Revision 0

DEPTH: _____

DATE: _____

SAMPLE TEAM ID: _____

SAMPLE LOCATION: _____
Facility Code Location ID

CLASS: FS (Field Sample)

SAMPLE NO.	SAMPLE TIME	SAMPLE TYPE *(circle one)*
		COMP GRAB
		COMP GRAB
		COMP GRAB
		COMP GRAB
		COMP GRAB

ATTACHMENT 2

APPENDIX 5.2

TEST PIT LOG

TEST PIT LOG

PAGE 1 OF ____

FACILITY CODE _____ EXCAVATOR CODE _____

LOCATION ID _____ EXCAVATION DATE _____

COORDINATES (FT): DEPTH (FTFD) _____

NORTH _____ EAST _____ CONSTRUCTION METHOD _____

GROUND ELEVATION (FT MSL) _____ ACCEPTANCE CODE _____

LOCATION TYPE TP _____

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT)

LOCATION DESCRIPTION

_____

_____

_____

_____

_____

LITHOLOGIC LOG

LOGGER CODE _____

DEPTH (FT)	SAMPLE INTERVAL	SAMPLE METHOD	SAMPLE #	USCS	VISUAL DESCRIPTION

ACCEPTANCE CODES: A–ACCEPTABLE R–RECONNAISSANCE U–UNACCEPTABLE N–NOT DETERMINED

CONSTRUCTION METHODS:

D – DUG
O – OTHER (SPECIFY)
T – TRENCHING

SAMPLE METHODS:

B – UNDISTURBED BLOCK
D – DISTURBED BULK

COMPLETE BOLDED DATA FOR ENTRY INTO TMS
TPO-004 (3/88)

FORM COMPLETED BY/DATE _____

TECHNICAL REVIEWER/DATE _____

APPENDIX 5.2, continued

TEST PIT LOG

PAGE ____ OF ____

FACILITY CODE ______________________________

LOCATION ID ______________________________ COMPLETION DATE __________

LITHOLOGIC LOG

DEPTH (FT)	SAMPLE INTERVAL	SAMPLE METHOD	SAMPLE #	USCS	VISUAL DESCRIPTION

COMPLETE BOLDED DATA FOR ENTRY INTO [illegible]
TPD-004 (3/88)

______________________ FORM COMPLETED BY/DATE

______________________ TECHNICAL REVIEWER/DATE

APPENDIX 5.3

DATA FORM COMPLETION INSTRUCTIONS

Use a pen with black ink that is not water soluble (not a felt-tip pen). Make an entry in each blank. Where there is no data entry, enter UNK for Unknown, NA for Not Applicable, or ND for Not Done. If any procedure was not performed as prescribed, give the reason for the change or omission on the form. To change an entry, draw a single line through it, add the correct information above it, and initial the change.

TEST PIT LOG

1. Facility Code. Five-character code abbreviating the facility name where program activity is being conducted. The first three characters indicate the facility, and the remaining two numbers designate the specific site within the facility.

2. Location ID. Four-character code assigned sequentially to each test pit location where physical, chemical, biological, radiological, and other measurements are taken.

3. Coordinates (Ft): North/East. The coordinates refer to the horizontal location of the test pit. At the time of the field investigation, the exact coordinate position of the borehole will not be known. In this case, UNK must be within the two spaces on the form. This information will be provided when the survey data comes in after the test pit program has been completed.

4. Ground Elevation (Ft MSL). At the time of the field investigation, the exact ground elevation of the test pit will not be known. In this case, the exact ground elevation will be determined when the survey data comes in after the program has been completed.

5. Location Type. This line is for data processing personnel only, and no additional information needs to be given on this line.

6. Excavator Code. Three-character code identifying the company responsible for excavating a test pit.

7. Excavation Date. The date when the test pit was excavated in the format DD-MMM-YY (01-JAN-88).

8. Depth (FTFD). The total depth of the test pit in feet and tenths of feet.

9. Construction Method. The construction or excavation method used in the advancement of the test pit. A table of various construction methods is included at the bottom of each Test Pit Log form.

10. Acceptance Code. One-character code assigned by the installation manager.

11. Groundwater Levels. The date, time, and depth (in feet) of any water encountered during the excavation of a test pit should be recorded by the distance from the ground surface to the location where it is seeping from the sides of the excavated trench.

12. Location Description. A written description of the approximate test pit location in respect to some nearby permanent topographic or geographic location.

13. Logger Code. Three-character code identifying the company that employs the person filling out the Test Pit Log form.

14. Lithologic Log

    a. Depth (Ft). A numerical designation that generally depicts lithologic soil boundaries. Each space is usually designated as equal to 1.0 ft of depth below the ground surface. Depths will be recorded on the Test Pit Log in feet and tenths of feet.

CONVERSION TABLE

(INCHES TO TENTHS OF FEET)

Inches	Tenths of Feet
1	.08
2	.17
3	.25
4	.33
5	.42
6	.50
7	.58
8	.67
9	.75
10	.83
11	.92
12	1.00

    b. Sample Interval. A graphical representation depicting the interval from which the sample was collected.

    c. Sample Method. The method by which the samples will be obtained. A list of test pit sampling methods is included at the bottom of each Test Pit Log form.

    d. Sample ID. Four-digit number assigned to ensure that data collected retains uniqueness from other data collected at the same location ID.

e. USCS (The Unified Soil Classification System). A method of grouping unconsolidated earth materials according to their engineering properties. It is based on soil behavior, which is a reflection of the physical properties of the soil and its constituents. The system established 15 distinct soil groups with different engineering properties. Boundary classifications are provided for soils having characteristics of 2 groups. The 15 soil groups are divided into the categories of fine-grained and coarse-grained materials and are described in Appendixes 5.4 and 5.5, respectively.

f. Visual Description. The visual description of material being excavated.

APPENDIX 5.4

CHECKLIST TO DESCRIBE FINE-GRAINED SOILS

1. Typical Name
   Sandy Silt, Silt, Clayey Silt, Sandy Clay, Silty Clay, Clay, Organic Silt, and Organic Clay

2. Size Distribution
   Approximate percent of gravel, sand, and fines in fractions finer than 3 inches

3. Color
   Note presence of mottling and banding, as well as color of the soil.

4. Moisture Content
   Dry, Moist, Wet, and Saturated

5. Consistency
   Soft, Firm (medium), Stiff, Very Stiff, or Hard

6. Structure
   Stratified, Laminated (Varved), Fissured, Blocky, Lensed, and Homogeneous (nonstratified)

7. Cementation
   Weak or Strong

8. Local or Geologic Name

9. Group Symbol

Soil Classification

Group Symbol	Group Name
CL	Lean clay (low plasticity)
ML	Silt
OL	Organic clay or silt (lean)
CH	Fat clay (high plasticity)
MH	Elastic silt
OH	Organic clay or silt (Fat)
PT	Peat

APPENDIX 5.5

CHECKLIST TO DESCRIBE COARSE-GRAINED SOILS

1. Typical Name
   Sand, Clayey Sand, Silty Sand, Gravel, Clayey Gravel, Silty Gravel, Cobbles, and Boulders

2. Gradation
   Well Graded (uniformly graded) or Poorly Graded (gap graded)

3. Size Distribution.
   Approximate percent of gravel, sand, and fines in fractions finer than 3 inches

4. Grain Shape
   Angular, Subangular, Subrounded, and Rounded

5. Color

6. Moisture Content
   Dry, Moist, Wet, and Saturated

7. Structure
   Stratified, Lensed, and Nonstratified

8. Cementation
   Weak and Strong

9. Local or Geologic Name

10. Group Symbol

Soil Classification

Group Symbol	Group Name
GW	Well-graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well-graded gravel
SP	Poorly graded gravel
SM	Silty sand
SC	Clayey sand